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PLATFORM SESSION 2

1. Syntactic ERP Effects in Broca's Aphasics with Agrammatic Comprehension

Marlies Wassenaar, Peter Hagoort, and Colin Brown

Max Planck Institute for Psycholinguistics, Nijmegen, The Netherlands

Introduction. Although some aphasic patients have been described who are agrammatic in language production but unimpaired in sentence comprehension (e.g., Kolk, Van Grunsven, & Keyser, 1985), the majority of patients with Broca's aphasia have syntactic problems when comprehending language. This phenomenon of agrammatic comprehension has been intensively studied, mainly by employing paradigms in which patients were asked to match sentences with pictures or to manipulate toys in acting-out tests (e.g., Caplan & Hildebrandt, 1988). Such paradigms, in contrast to on-line methods, are less suited to tap the processes involved in syntactic comprehension as they unfold in real time. An on-line method which is useful for studying syntactic comprehension processing in Broca's aphasics is the recording of event-related brain potentials (ERPs). One particular ERP-component, the Syntactic Positive Shift (SPS), has been found to be sensitive to on-going syntactic processing. The SPS is a positive polarity brain potential that starts at about 500 ms following relevant stimulation and has been observed in response to a number of syntactic violations (e.g., Hagoort, Brown, & Groothusen, 1993). In the current study the SPS is used as a tool to study syntactic comprehension problems in patients with Broca's aphasia. Next to the SPS, the N400 is a well-known ERP component, related to semantic processing. The N400 component is also relevant for this study.

Method. The ERP experiment focused on syntactic integration processes within and across phrasal boundaries. The subjects were presented with spoken sentences in Dutch containing violations of (1) phrase structure rules (transpositions of adverbs and adjectives in Adv-Adj-N sequences), and (2) violations of subject-verb agreement (both in a simple and complex constituent structure, in order to vary syntactic complexity). For example (critical regions are italicized; literal English translations in brackets):

- (1a) Mijn broer gebruikt een *nogal oude* computer voor zijn studie.
(My brother uses a *rather old* computer for his studies.)
- (1b) *Mijn broer gebruikt een *oude nogal* computer voor zijn studie.
(My brother uses an *old rather* computer for his studies.)

- (2a) De vrouwen betalen de bakker en *nemen* het brood mee naar huis.
(The women pay the baker and *take* the bread home.)
- (2b) *De vrouwen betalen de bakker en *neemt* het brood mee naar huis.
(The women pay the baker and *takes* the bread home.)
- (2c) De vrouwen die de bakker betalen, *nemen* het brood mee naar huis.
(The women who pay the baker, *take* the bread home.)
- (2d) *De vrouwen die de bakker betalen, *neemt* het brood mee naar huis.
(The women who pay the baker, *takes* the bread home.)

The subjects were asked to listen attentively to the sentences. No additional task demands were imposed.

Subjects. Ten patients with aphasia secondary to a single CVA in the left hemisphere, and twelve normal elderly control subjects participated in the experiment. All patients were diagnosed as Broca's aphasics on the basis of the standardized Dutch version of the Aachen Aphasia Test and on the basis of a transcribed sample of the patients' spontaneous speech. Agrammatic comprehension was further examined by an off-line sentence picture matching test for syntactic sentence comprehension. This test consists of five different sentence types, namely: (1) active, semantically irreversible sentences, (2) active, semantically reversible sentences, (3) simple passive sentences, (4) sentences with a relative clause containing a prepositional phrase, and (5) embedded passive sentences. The different sentence types assess the influence of (increasing) syntactic complexity on sentence comprehension.

On the basis of their performance on this off-line test, the aphasic patients were divided into two groups (High versus Low Comprehenders; see Fig. 12). Both the High ($N = 5$) and Low Comprehenders ($N = 5$) showed a significant decrease in comprehension with increasing syntactic complexity, with the Low Comprehenders performing significantly worse than the High Comprehenders. Twelve normal control subjects, matched in age and education to these patients, were also tested.

Results and discussion. In the normal elderly control subjects SPS effects were found for the phrase structure and subject-verb agreement violations. The latter effect was not modulated by syntactic complexity. The ERP results of both the High and Low Comprehenders deviated from the results of the elderly controls. The High Comprehenders showed an SPS with the same latency but a smaller amplitude than the control subjects for both the phrase structure violations and the agreement violations in the simple constituent structure. The effect for the agreement violations in a complex constituent structure failed to reach significance. This pattern of results indicates that

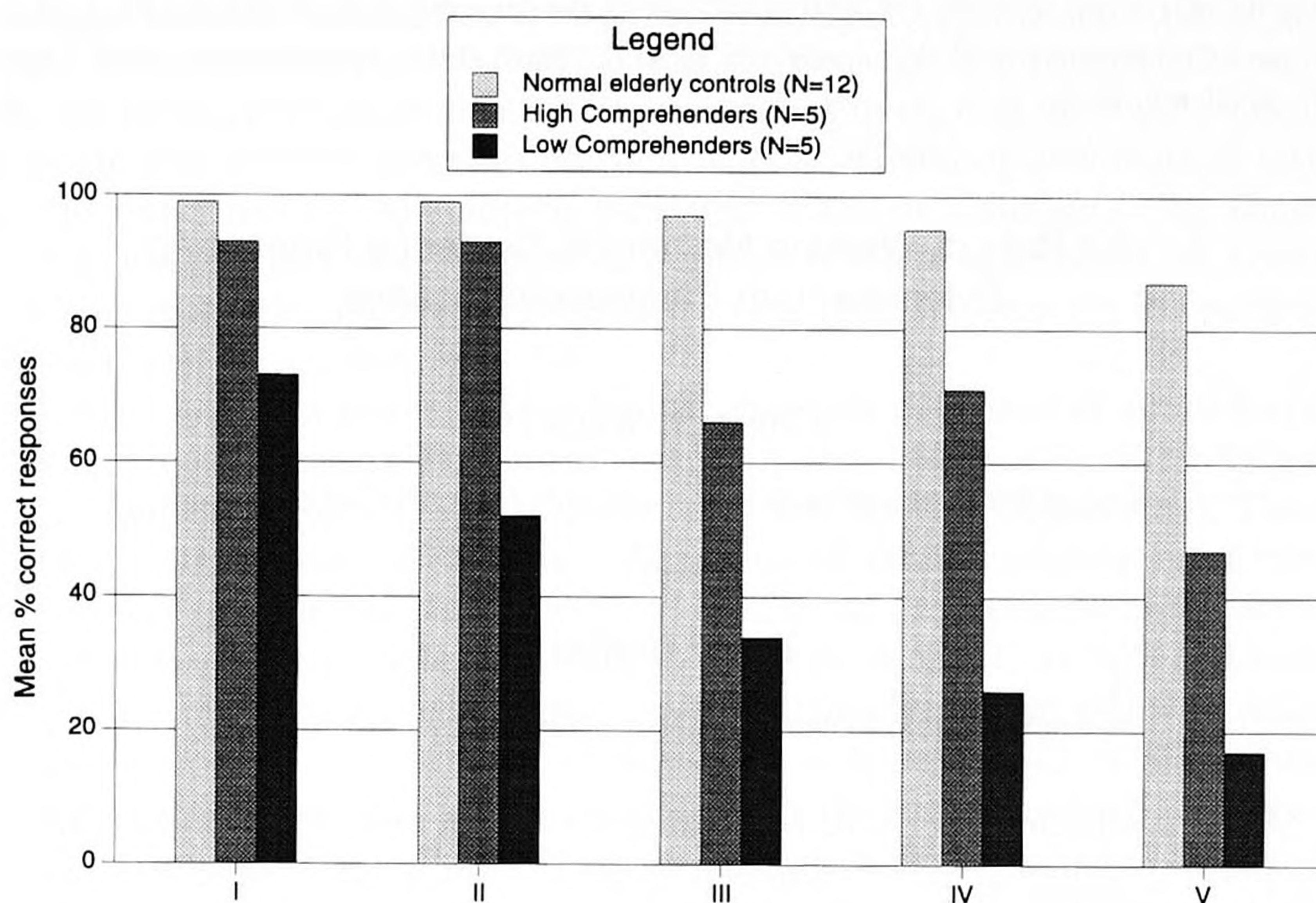


FIG. 12. Static off-line test. Mean percentage correct responses for Normal elderly Controls, High Comprehenders and Low Comprehenders for 5 different sentence types: (I) Active, semantically irreversible; (II) Active, semantically reversible; (III) simple passive; (IV) relative clause containing a prepositional phrase; (V) embedded passive.

the High Comprehenders still have available, at least in part, the processing machinery for the assignment of syntactic structure.

In contrast to the High Comprehenders, some Low Comprehenders showed a delayed positive shift for the phrase structure violations, which might indicate a considerable delay in the time course of their syntactic integration. Other Low Comprehenders showed no SPS but an N400 effect instead, suggesting the use of a compensatory semantic strategy for sentence interpretation. In the Low Comprehenders no effects were found for the agreement violations.

In summary, the quantitative difference in the off-line test performance of the High and Low Comprehenders was accompanied by a qualitative difference in their ERP data, with either reductions or delays of syntactic ERP effects, or no such effects but instead modulations of the semantic N400 component.

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2. The Role of Working Memory in Sentence Processing: Evidence from Parkinson's Disease

Gloria S. Waters

School of Communication Sciences and Disorders, McGill University

and

David Caplan

Neuropsychology Laboratory, Massachusetts General Hospital

Many psycholinguists have been interested in the role that working memory plays in language processing and in the possibility that reductions in the capacity of this system may underlie certain types of language disorders. Data from patients with Parkinson's Disease (PD) have been taken as evidence for a relationship between an impairment in syntactic processing and a reduction in working memory capacity, since these patients have been found to have both impairments in executive functions and impairments in structuring sentences syntactically. However, the nature of the sentence comprehension impairments seen in PD and their relationship to impairments in executive functions and processing resource reductions is far from clear.

Most studies of sentence processing in PD have used sentence comprehension tasks that have heavy post-interpretive demands and so may have led to an exaggerated view of the deficits these patients have in assigning syntactic form and understanding the literal meaning of a sentence. In addition, in many studies the syntactic complexity of the stimulus materials is confounded with other factors, such as length and propositional density, and so it is likely that these other factors may account for the results. Finally, most studies have not measured working memory in the PD patients whose sentence processing was tested. Even if PD patients do have impairments in structuring sentences syntactically, it is necessary to demonstrate that these patients have an impairment in working memory and to relate this impairment to their processing of syntactic form to examine the relationship between these two cognitive domains. This study reconsiders the relationship between working memory and syntactic processing in PD, using tasks and materials that address these issues.

Method. Subjects: The subjects were 23 PD patients and 15 controls. The mean ages of the PD patients and controls were 70.1 and 71.6 years respectively and the mean number of years of education were 14.9 and 13.5, respec-